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flora grows at Dixie Landing with the conditions under which *Æ. Lamarckiana* occurs at its European stations. The race of *Æ. Lamarckiana* which occurs at Hilversum is unmixed, since no other species of *Enothera* grows at that locality. Of its mutants only *Æ. laeviflora* and *Æ. brevistylis* have been observed to flower regularly in the field: the other forms either do not flower at all or only so rarely as to have hardly any influence on the purity of the strain. In the sand dunes of Holland, on the contrary, *Æ. Lamarckiana* is mixed, as a rule, with European *Æ. biennis* and is observed to produce the three different hybrids which are obtained when these two species are artificially hybridized. The same statement holds good for many localities where the two species grow in France and England. Every individual from such a station, however closely its external characters may seem to coincide with those of one of the parent species, must always lie open to the suspicion of having had a hybrid ancestry.

In connection with the fact that the Dixie Landing types are so sharply divisible into two groups, it is permissible to suggest that they may correspond in a general way with hybrids between *Æ. Lamarckiana* and *Æ. biennis* "Chicago" which have already been studied. From the cross *Æ. Lamarckiana* × *Æ. biennis* "Chicago" and its reciprocal, two pairs of twin hybrids were obtained at Amsterdam in the first generation, viz., *Æ. læta* and *Æ. velutina*, and *Æ. densa* and *Æ. laxa*. The first pair of twins, from the cross *Æ. Lamarckiana* × *Æ. biennis* "Chicago," has already been described, the other pair, from the reciprocal cross, will soon be published in another paper. Possibly one group of the Dixie Landing types is related to *Æ. grandiflora* in the same way that *Æ. densa* and *Æ. læta* are related to *Æ. Lamarckiana*, and the other group to *Æ. Tracyi* as *Æ. laxa* and *Æ. velutina* are related to *Æ. biennis* "Chicago." Of course the situation at Dixie Landing is probably complicated by the recrossing of the hybrids with themselves and with their parents. However that may prove to be, the Dixie Landing types are now available for

study and it is hoped that future work may show in what manner they are related. At the present time no conclusion regarding them is justified other than that they constitute so mixed a population that it is quite impossible to distinguish original parent types, if any such exist there, from the derivative types associated with them. In case the two most common types represent the original strains, the presence in other types of characters which are not common to either hypothetical parent suggests that *Æ. grandiflora* and *Æ. Tracyi* may prove to be additions to the list of species, including *Æ. Lamarckiana*, *Æ. cruciata* "Adirondack," European *Æ. biennis*, and *Æ. biennis* "Chicago," which are known to be in a mutable condition.

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THE GREAT CRESTED GREBE AND THE IDEA OF SECONDARY SEXUAL CHARACTERS

CERTAIN facts in the structure and habits of this bird (*Podiceps cristatus* L.) have such a general bearing upon the whole conception of secondary sexual characters that it seems desirable to publish them here. The facts are these: the great crested grebe possesses an erectile ruff at the sides of the neck and a pair of erectile tufts on the head. The male is slightly larger in total size, and his ruff and tufts are also slightly larger, relatively as well as absolutely; otherwise the sexes are identical. The ruff and tufts are used extensively in courtship; at other times they are only occasionally erected, and then never to their full extent. The courtship-actions, including all the movements of ruff and tufts, are identical in the two sexes. The ruff and tufts and the actions in which they are concerned would be called secondary sexual characters, were they not common to both sexes, for secondary sexual characters are always defined with regard to this very point, their difference in the two sexes. I take a random

definition, chosen for its brevity. Dewar and Finn¹ say that they are "those characters which differ with the sex, but are not directly connected with the act of reproduction." Darwin² defines them very similarly, but then adds:³

There are, however, many animals in which the sexes resemble each other, both being furnished with the same ornaments, which analogy would lead us to attribute to the agency of sexual selection. . . . It is probable that the ornaments common to both sexes were acquired by one sex, generally the male, and then transmitted to the offspring of both sexes.⁴

As far as I can understand, however, he is talking merely of structures, not of those combinations of a structure with the instinct for displaying that structure which constitute the real secondary sexual *characters*.

The grebe is, so far as I know, unique in this—that structures which are only used in courtship (*i. e.*, which must *in origin* be due to sexual and not to natural selection) are now not only the common property of both sexes, *but are actually used in display, and used in exactly the same way by both sexes.*

The question of nomenclature remains; what are we to call characters like these, that have arisen through sexual selection, but exist equally in both sexes? The term "secondary sexual," as we have seen, will not do. A word does exist, however, which is perfectly applicable, and that is the word *epigamic*.⁵ It would indeed be more satisfactory if we were always to use the term *epigamic* of all characters that owed their origin to sexual selection, whether they are found in one or both sexes, and keep the term *secondary sexual* in the wider sense that it often has now, to in-

clude *all characters peculiar to one sex except the primary sexual characters* (of gametes and gonads) *and the accessory sexual characters* (of genital ducts, copulatory apparatus, etc.). This would cover such epigamic characters (the great majority) that are confined to one sex, as well as many other characters, such as the mammæ of female mammals or the wingless condition of various female moths, which are not epigamic, nor accessory in the strict sense of directly helping the union of the gametes, but have been evolved through natural selection to perform some special function of their own.

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VOLCANIC ACTION IN THE BLACK HILLS OF SOUTH DAKOTA¹

IN recent work on geology of the northern Black Hills I have found a sheet of obsidian and associated agglomerates which doubtless are the products of surface extrusion. The locality is 1½ miles northwest of Roubaix or 6 miles south by east of Deadwood in the midst of a large area of pre-Cambrian schists. The many large masses of igneous rocks in this region are well known from descriptions by Newton, Crosby, Jaggar and others, but so far as recorded they are of intrusive nature and of early Tertiary age. The White River deposits (Oligocene) in and about the Black Hills contain large amounts of fragments of these igneous rocks, the products of erosion, and also much volcanic ash of contemporaneous origin. The source of this ejected material has always been a problem, and while the effusive rocks near Roubaix can not be precisely correlated with White River deposits they appear to indicate that there was volcanic action in this region in mid-Tertiary time.

The obsidian is a sheet about 15 feet thick and of small extent. Its smooth lower surface lies on a one-foot layer of impure volcanic ash which is underlain by a thick mass of agglomerate or flow breccia of apparent rhyolite

¹"The Making of Species," 1909, p. 298.

²"Descent of Man," 1871, p. 253.

³*Ibid.*, p. 277.

⁴There is no necessity to multiply quotations; I will merely refer the reader to some apposite passages, *e. g.*, Poulton, "Essays on Evolution," 1908, pp. 379, 380; Archdall Reid, "Laws of Heredity," 1910, p. 145; Weismann, in "Darwin and Modern Science," 1909, pp. 43, 48; in "The Evolution Theory," 1904, Vol. I., pp. 232, 233.

⁵Poulton, *loc. cit.*

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